WHAT IS CLAIMED IS:

1. A method for manufacturing a white colored light-emitting device (LED), comprising:

   (a) forming a second MQW active layer over an upper side of a substrate, performed after a buffer layer formed on said substrate, and wherein said second MQW active layer comprises a material so that said second MQW active layer emits a second light when excited;

   (b) forming an n-GaN based epitaxial layer over said second MQW active layer;

   (c) forming a first MQW layer over said n-GaN based epitaxial layer, wherein said first MQW active layer comprises a material so that said first MQW active layer emits a first light with a presence of an electric power applied, and wherein said second light has a longer wavelength than a wavelength of said first light, and said first and second lights mix into a white colored light;

   (d) forming a p-type distributed Brag reflector (DBR) over said first MQW active layer;

   (e) forming a p-GaN based layer over said p-type DBR, etching away a portion of said n-GaN based, said first MQW active, said p-type DBR and said p-GaN based layers whereby said n-GaN based layer has an exposing region and disposing an n-type electrode over said exposing region of said n-GaN based layer and a p-type electrode over said p-GaN based layer, said electric power is applied between said p-type and n-type electrodes; and

(f) coating a metal reflector over a bottom side of said substrate.

2. The method as in Claim 1, wherein said second light has a wavelength of 550-650 nm while said first light has a wavelength of 450-510 nm.

3. The method as in Claims 1, wherein said p-type DBR is made of a p-GaN based material and wherein said substrate comprises sapphire, silicon carbide (SiC) and gallium nitride (GaN) and wherein said first and second MQW active layer are InGaN/GaN layers.

4. The method as in Claims 2, wherein said first and second wavelengths of said first and second lights are obtained by adjustments of said In dopant concentrations of said first and second MQW active layers.

5. A white colored light-emitting device (LED), comprising:

a resonant cavity structure formed with a metal reflector, a substrate formed over said metal reflector, a buffer layer formed over said substrate, a second MQW active layer formed over said buffer layer, an n-GaN based layer formed over said second MQW active layer, a first MQW active layer formed over said n-GaN based layer and a p-type distributed Bragg reflector (DBR) formed over said first MQW active layer, wherein said p-type DBR has a reflectance;

a contact layer comprising a p-GaN based layer and formed over said p-type DBR;

an n-type metal electrode disposed over an exposing region of said n-GaN layer; and

a p-type metal electrode disposed over said contact layer;

wherein said second MQW active layer comprising a material so that

said second MQW active layer generates a second light having a second wavelength when excited; while said first active MQW active layer comprises a material so that said first active MQW layer generates a first light having a first wavelength with a presence of an electric power applied between said n-type metal electrode and said p-type metal electrode, and said second wavelength is larger than said first wavelength and said first light and second lights mix into a white colored light.

6. The light-emitting device as in Claim 5, wherein said second wavelength is 550-650 nm while said first wavelength ranges between 450 nm to 510 nm.

7. The light-emitting device as in Claim 5, wherein said substrate comprises sapphire, silicon carbide (SiC) and gallium nitride (GaN) and wherein said p-type DBR is a p-GaN based material.

8. The light-emitting device as in Claim 5, wherein said contact layer is a p-InGaN or a p-AlInGaN layer.

9. The light-emitting device as in Claim 5, wherein said reflectance of said p-type DBR ranges from 50% to 80% while said metal reflector has a reflectance of greater than 90% and comprises any kind of metals and alloy thereof.

10. The light-emitting device as e in Claim 5, wherein the light-emitting device further comprises a transparent contact layer (TCL) formed over said contact layer and conductive and transparent to a light with a wavelength of 400- 700 nm.

11. The method as in Claims 6, wherein said first and second wavelengths of said first and second lights are obtained by adjustments of said In dopant

concentrations of said first and second MQW active layers.

12. A white colored light-emitting device (LED), comprising:

a substrate comprising sapphire;

an LT-GaN/HT-GaN buffer layer having a first formed low temperature GaN buffer layer on said substrate and a then formed HT-GaN buffer layer on said LT-GaN buffer layer wherein said LT-GaN buffer layer has a thickness of 30 to 500 Å while said HT-GaN buffer layer has a thickness of 0.5 to 6 μ m;

an InGaN/GaN second MQW active layer;

an n-GaN semiconductor layer having a thickness of 2 to 6 μ m;

an InGaN/GaN first MQW active layer;

a p-AlGaN/GaN distributed Bragg reflector (DBR); and

a p^+-GaN based semiconductor contact layer having a thickness of 0.2 to 0.5 μ m;

an n-type metal electrode disposed over an exposing region of said n-GaN based layer; and

a p-type metal electrode disposed over said p^+-GaN based semiconductor layer;

wherein said substrate is coated with a metal reflector on a bottom side of said substrate, wherein said metal reflector has a thickness of 50 Å to 10 μ m and made of a conductive metal or metal alloy, and

wherein said InGaN/GaN second MQW active layer has a second In dopant concentration so that said second MQW active layer generates a second light having a wavelength of 550-650 nm when excited while said

InGaN/GaN first MQW active layer has a first In dopant concentration so that said InGaN/GaN first MQW active layer generates a first light having a wavelength of 450-510 nm when an electric power is applied between said n-GaN semiconductor layer and said p-AlGaN/GaN distributed Bragg reflector (DBR).

13. The light-emitting device as in Claim 12, wherein said substrate further comprises silicon carbide (SiC) and gallium nitride (GaN) and has a thickness of 50 μm to 300 μm, and wherein said conductive metal of said metal reflector comprises Ag, Al and other metallic materials.

14. The light-emitting device as in Claim 12, wherein said p^+-GaN based semiconductor layer further comprises a p^+-InGaN layer or a p^+-AlInGaN layer.

15. The light-emitting device as in Claim 12, wherein said p^+-GaN based semiconductor layer is further coated with a transparent contact layer (TCL) and said TCL is conductive and transparent to a light having a wavelength of 400 nm to 700 nm and has a thickness so that said first and second lights may properly penetrate through said TCL.

16. A method for manufacturing a white colored light-emitting device (LED), comprising:

(a) forming an n-type DBR on an upper side of a substrate, performed after a buffer layer is formed over said substrate;

(b) forming a second MQW active layer over said n-type DBR, performed after a buffer layer formed on said substrate, wherein said second MQW active layer comprises a material so that said second MQW active

layer emits a second light having a second wavelength when excited;

(c) forming an n-GaN based epitaxial layer over said second MQW active layer;

(d) forming a first MQW layer over said n-GaN based epitaxial layer, wherein said first MQW active layer comprises a material so that said first MQW active layer emits a first light having a first wavelength with a presence of an electric power and said first and second lights mix into a white colored light;

(e) forming said p-type distributed Brag reflector (DBR) over said first MQW active layer; and

(f) forming a p-GaN based layer over said p-type DBR, etching away a portion of said n-GaN, said first MQW active, said p-type DBR and said p-GaN layers whereby said n-GaN has an exposing region and disposing an n-type electrode over said exposing region of said n-GaN based layer and a p-type electrode over said p-GaN based layer, wherein said electric power is applied between said n-type electrode and said p-type electrode.

17. The method as in Claim 16, wherein said substrate comprises sapphire, silicon carbide (SiC), silicon (Si) and gallium nitride (GaN).

18. The method as in Claim 16, wherein said n-type DBR comprises an n-GaN based layer while said p-type DBR comprises a p-GaN based layer.

19. The method as in Claim 16, wherein said second wavelength is 550-650 nm while said first wavelength ranges between 450 nm to 510 nm.

20. The method as in Claims 19, wherein said first and second wavelengths of said first and second lights are obtained by adjustments of said In dopant

concentrations of said first and second MQW active layers.

21. A white colored light-emitting device (LED), comprising:

a substrate having a buffer layer thereon;

a resonant cavity structure formed over said buffer layer comprising an n-type distributed Bragg reflector (DBR) over said buffer layer, a second multi-quantum well (MQW) active layer over said n-type DBR, an n-GaN based layer over said second MQW active layer, a first MQW active layer over said n-GaN based layer and a p-type DBR over said first MQW active layer;

a contact layer comprising a p-GaN based layer and formed over said p-type DBR;

an n-type metal electrode disposed over an exposing region of said n-GaN based layer; and

a p-type metal electrode disposed over said contact layer;

wherein said InGaN/GaN second MQW active layer has a second In dopant concentration so that said second MQW active layer generates a second light having a second wavelength when excited while said InGaN/GaN first MQW active layer has a first In dopant concentration so that said InGaN/GaN first MQW active layer generates a first light having a first wavelength when an electric power is applied between said n-type metal electrode and said p-type metal electrode and said second wavelength is longer than said first wavelength.

22. The light-emitting device as in Claim 21, wherein said substrate comprises comprising sapphire, silicon carbide (SiC), silicon (Si) and gallium nitride

(GaN).

23. The light-emitting device as in Claim 21, wherein said second wavelength is between 550-650 nm and said first wavelength has a wavelength of 450-510 nm.

24. The light-emitting device as in Claim 21, wherein said contact layer comprises a p-InGaN layer or a p-AlInGaN epitaxial layer.

25. The light-emitting device as in Claim 21, wherein indexes of refraction of said n-type DBR and p-type DBR are both less than 90%, and are formed of n-GaN based layer and p-GaN based layer respectively.

26. The light-emitting device as in Claim 21, wherein said light-emitting device further comprises a TCL formed over said contact layer and transparent to a light with a wavelength of 400-700 nm.

27. The light-emitting device as in Claims 23, wherein said first and second wavelengths of said first and second lights are obtained by adjustments of said In dopant concentrations of said first and second MQW active layers.

28. A white colored light-emitting device (LED) structure, comprising: /

an LT-GaN/HT-GaN buffer layer having a first formed LT-GaN buffer layer on a substrate and a then formed HT-GaN buffer layer on said LT-GaN buffer layer, wherein said LT-GaN buffering has a thickness of 30 to 500 Å while said HT-GaN buffer layer has a thickness of 0.5 to 6 μ m;

an n-AlGaN/GaN distributed Bragg reflector (DBR);

an InGaN/GaN second MQW active layer;

an n-GaN semiconductor layer having a thickness of 2 t0 6 μ m;

an InGaN/GaN first MQW active layer;

a p-AlGaN/GaN DBR;

a p^+-GaN based semiconductor layer having a thickness of 0.2 to 0.5 μ m; an n-type metal electrode disposed over an exposing region of said n-GaN based layer; and

a p-type metal electrode disposed over said p^+-GaN based semiconductor layer;

wherein said InGaN/GaN second MQW active layer has a second In concentration so that said InGaN/GaN second MQW active layer generates a second light having a second wavelength between 550-650 nm when excited while said InGaN/GaN first MQW active layer has a first In dopant concentration so that said In GaN/GaN first MQW active layer generates a first light having a first wavelength between 450-510 nm with a presence of an electric power applied between said p-type metal electrode and said n-type metal electrode, and said first light and said second light mix into a white light.

29. The light-emitting device as in Claim 28, wherein said substrate comprises sapphire, silicon carbide (SiC), silicon (Si) and gallium nitride (GaN).

30. The light-emitting device as in Claim 28, wherein said contact layer comprises a p-InGaN layer or a p-AlInGaN epitaxial layer.

31. The light-emitting device as in Claim 28, wherein indexes of refraction of said n-type DBR and p-type DBR are both less than 90%, and are formed of n-GaN based layer and p-GaN based layer respectively.

32. The light-emitting device as in Claim 28, wherein said light-emitting device further comprises a TCL formed over said contact layer and transparent to a

light with a wavelength of 400-700 nm.

33. A light-emitting device (LED) capable of emitting a light with a specified wavelength, comprising:

a resonant cavity structure comprising a substrate, a buffer layer on said substrate, a lower n-type reflecting semiconductor layer over said buffer layer, a second MQW active layer over said lower n-type reflecting semiconductor layer, an n-GaN based layer over said second MQW active layer, a first MQW active layer over said second MQW active layer and an upper p-type reflecting semiconductor layer over said first MQW active layer;

a contact layer formed over said p-type DBR, wherein said contact layer comprising a p-GaN based layer;

an n-type metal electrode disposed over an exposing region of said n-GaN layer; and

an p-type metal electrode disposed over said contact layer;

wherein said second MQW active layer comprising a material so that said second MQW active layer generates a second light with a second wavelength when excited; while said first active MQW active layer comprises a material so that said first active MQW layer generates a first light with a first wavelength in response to a presence of an electric power applied between said n-type metal electrode and said p-type metal electrode, and said second wavelength is longer than said first wavelength.

34. The light-emitting device as in Claim 33, wherein said second MQW active layer comprises an InGaN/GaN layer with a second In dopant concentration

while said first MQW active layer comprises an InGaN/GaN layer with a first In dopant concentration and wherein said first and second wavelengths of said first and second lights are obtained by adjustments of said first and second In dopant concentrations.